User's Guide

to BubbleBead Filters

Models 3, 5, 7 & 9 ('TwinValve')

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BubbleBead Filtration for Koi Ponds

THE REQUIREMENT FOR FILTRATION

Koi, and similar ornamental fish kept in any numbers, need some form of filtration for their ponds. Koi soon pollute their surroundings due to their greedy appetites and vigorous browsing nature, churning up the pool base. Any form of filtration needs to remove the suspended solids (mechanical filtration) **and** break down the dissolved fish wastes (biological filtration) to give both clear water for viewing and clean water for fish health.

THE CAPABLE BUBBLEBEAD FILTER SYSTEM

The BubbleBead filter system is ideally suited to koi ponds, and has been scientifically proven to remove particles to 15 micron size and below, whilst at the same time efficiently breaking down biological wastes[1] . A correctly sized unit can achieve this clean & clear water quality on its own, or it can be used in conjunction with ancillary filter equipment.

SELF-CLEANING FILTER FUNCTION

In the past, however advanced the filter system design, efficiency has suffered due to lack of regular maintenance. This has proved a major problem with many of the common 'box' and 'chamber' type filter systems where sediments can build up in the units, rapidly releasing nutrients that promote blanketweed and other algae. This is not a problem for the BubbleBead filter where the hands-free backwash process can be easily set up to run in a **fully automatic** regime, regularly flushing out collected wastes. This makes it the first truly 'self-cleaning' filter system to be introduced onto the koi market – a feature of the ingenious patented valve system now fitted as standard to BubbleBead filters (Models 3, 5, 7 & 9). The self-cleaning process can also significantly reduce pond algae growth.

BOOST EXISTING FILTER SYSTEMS ALSO

BubbleBead filters have shown themselves to be ideal to boost fish stock capacity and solids removal in existing koi ponds where the current filter system is becoming overloaded. For details of how to best integrate a BubbleBead filter with existing filter equipment, see Appendix Two. The compact size of the BubbleBead filter and its ability to be sited remotely makes it ideal for retro-fitting in these cases, with minimal disruption to the surrounds of the existing pond.

The Principle behind all Biological Filter Systems

THE LIMITATIONS OF 'NATURAL' FILTRATION

In natural lake ecosystems, micro-organisms build up on the surfaces of rocks, plants etc. and help to break down wastes from the limited numbers of fish present. In artificial systems, sediments are usually removed and pools often kept clinically clean. The remaining micro-organisms struggle to cope with the wastes from the relatively high numbers of fish stocked.

THE PURPOSE OF FILTRATION SYSTEMS

The natural micro-organisms that break down fish wastes are concentrated in an external filter system. Water from the pool is re-circulated through the filter to bring in the wastes, oxygen and other nutrients that these organisms feed on. The filter also needs to remove suspended solids to prevent the water from becoming turbid. To prevent the filter itself from becoming clogged, the dirt needs to be periodically removed from the filter. In simple 'box' filters this has often been achieved with some form of foam pad, though cleaning of such pads can be a messy and time consuming process that can also upset the biological processes establishing in the filter.

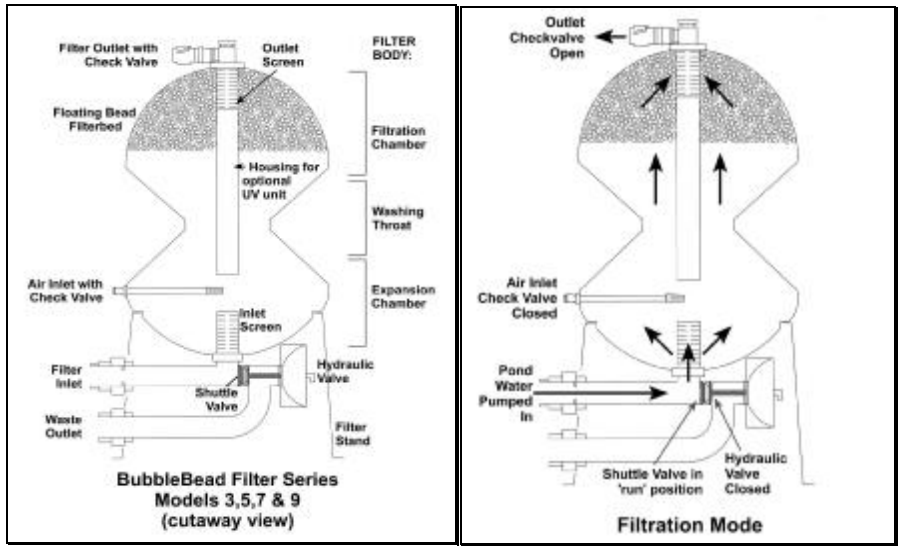
With browsing fish such as koi, the sediments are constantly disturbed into suspension, aiding their transfer to the filter system. Removal of pool sediments is usually supplemented e.g. by the addition of bottom drains that can be flushed to waste, or the use of vacuuming devices.

The Principle behind BubbleBead filters

BubbleBead filters are based around a media of small (3 x 5 mm), floating plastic beads. In normal running, the beads pack to form a filter bed that efficiently captures solids by a combination of processes including straining and interception by the biological film that forms on the surface of the beads[3]. The very high surface area of the beads allows for the attachment of large numbers of beneficial filter bacteria, which break down fish wastes. Models 3,5,7 & 9 also include all the necessary valves for automatic back-washing.

STANDARD FLOW PATTERN

Water is pumped in, through the inlet screen and up through the unit. The floating beads pack down into a filter bed in the top of the unit, where both biological breakdown of wastes and mechanical filtering of solids takes place. Filtered water leaves through the outlet screen and outlet checkvalve (the checkvalve type varies).



DIFFERENCES FROM OTHER TYPES OF FILTER

Unlike sand filters, the floating nature of the beads and the bead size allow for simpler cleaning and less powerful pumps. The regular, gentle, bubble-wash process ensures that the beads stay coated with a thin healthy layer of filtration organisms functioning at peak efficiency.

Unlike fluidised bed filters, there is no danger of the bead media breaking down or being washed out of the filter. The beads last virtually indefinitely and the inlet and outlet strainers prevent accidental loss. BubbleBead filters also effectively remove solids from the water, something a fluidised bed filter is incapable of doing.

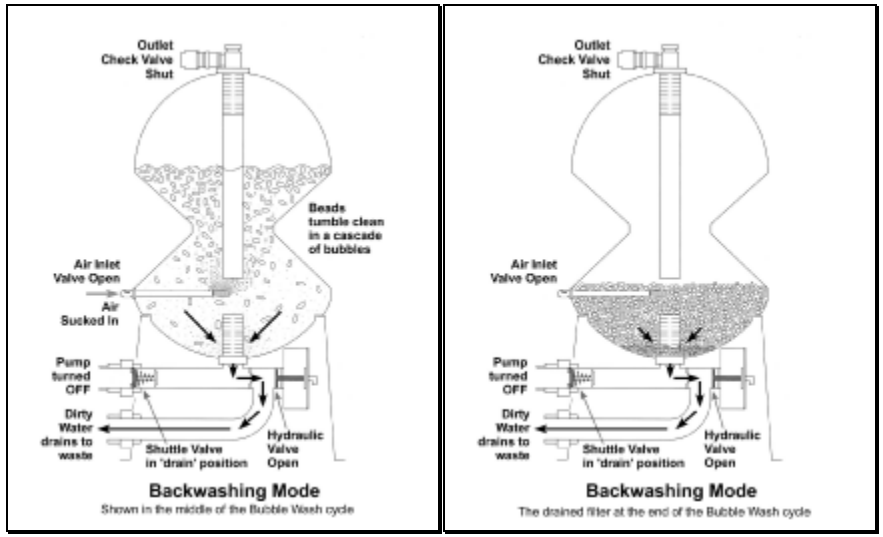
CUTTING EDGE TECHNOLOGY

Bead filters have been in development since the early 1980's leading to the design and patenting of the BubbleBead filter by Ronald F. Malone at

Louisiana State University. The distinctive hourglass shape and the bubble washing process is a key to its effectiveness (features which are missing from systems that seek to imitate the BubbleBead filter's success). The gentle bubble-wash, as the beads tumble through the washing throat, removes dirt whilst leaving just the right amount of biological film on the bead surface. Alternative means of cleaning the beads (e.g. propellers or water jets) carry a risk of removing too much of the beneficial biological film, with a consequent drop in water quality. BubbleBeads avoid this risk.

With the recently patented integral valve system (allowing automatic backwash without the need for expensive solenoid valves); and improved pressure tolerance with large pumps - BubbleBead filters remain at the cutting edge of filtration technology.

The Backwash Process



As soon as the pump is turned off, the valve systems take over to start the automatic backwashing process. There are no valves to open and there is no need to get your hands wet or dirty from cleaning media – the work is done for you!

The outlet one-way checkvalve closes as soon as the pump flow ceases, and air is then drawn in through the air one-way checkvalve. The shuttle valve springs back down the inlet pipe and the weight of water in the filter

holds the shuttle valve in the 'drain' position, allowing water to drain through the waste outlet, but preventing any water from draining back into the pond through the pump.

The hydraulic valve **gradually** opens, and waste water starts to drain through the waste outlet. As the filter empties, the beads drop through the washing throat and are tumbled clean in a cascade of foaming water and air bubbles.

RESTARTING AFTER THE BACKWASH

Once dirty water has flushed to waste, the pump can be re-started. As soon as the pump is turned on, the force of water moves the shuttle valve to the 'run' position (with a 'clunk' sound), and water is directed up into the filter. A small amount of water may initially continue to trickle from the waste outlet past the shuttle valve. As the filter starts to fill, the hydraulic waste valve automatically closes and completely seals the waste outlet – this can take a minute. This 'TwinValve' closure system gives extra protection against valve failure, each valve acting as a back-up for the other. Together they ensure that pond water cannot be accidentally pumped directly to waste. It is important that these two valves are correctly maintained to retain this safety factor (see page 32).

How does such a compact filter compare with large chamber filters?

The gentle, bubble wash process is a key to the efficiency of the BubbleBead filter. It aids cleaning of the beads whilst maintaining the biological film on the bead surface in a healthy condition. This ensures that the maximum proportion of bead surface area is available for biological filtration to take place. The regular backwash also removes solids from the system **before** they break down.

MEDIA EFFICIENCY

In many conventional filter systems, sediments build up in the biological media, and the surfaces become coated in an excess thickness of biological film. Together, these reduce the efficiency of the biological media and to compensate, such systems require a much greater volume of media. Regular removal of sediments in the BubbleBead system allows the compact media to function at full efficiency.

BUILD-UP OF UNWANTED SOLIDS

Chamber and vortex systems often retain large amounts of solids on ledges within the units and on media such as brushes or plastic rings. Unless such filters are rigorously maintained with frequent laborious removal of solids, the wastes will break down to release significant amounts of nutrients back into the water. This process not only consumes large amounts of oxygen from the water but also encourages growth of algae due to the release of soluble nutrients into the water.

In BubbleBead filters this removal of waste solids is carried out regularly and automatically, most solids being removed from the system before they have a chance to release all their nutrients back into the water. Remember too that the bubble-wash process is different from pump or propeller washed bead filters, where great care is necessary to prevent overcleaning of the beads and resultant loss of the vital biological film. The BubbleBead filter's gentle bubble-wash makes overcleaning virtually impossible.

Choosing the correct size of filter; pump and U/V

The correct size of filter is calculated according to **both** the **weight** of fish in the system and the overall system **volume**.

The fish loading on the filter is related to the amount of waste that they produce, and this in turn is related to the amount of food that the fish consume. As most koi keepers are unlikely to have weighed their fish, the simplest way of relating filter size to fish stocks is to weigh an amount of fish food equivalent to the maximum amount fed in one day.

Experience has shown that bead filters can cope with a loading of up to 225 grams / ½ lb of food per cubic foot of media per day whilst giving water quality acceptable for ornamental fish[1,2]. (This is equivalent to up to 23 Kg / 50 lb of koi fed at a 1% feed rate; see table on page 11 for details). For maximum water clarity and the best water quality this figure is halved to an upper limit of 113 grams / ¼ lb of food per day per cubic foot of bead media. These figures are based on the bead media supplied and typical pelleted foods with a protein content of around 35%. The feed rate for very high protein 'growth' foods would need to be reduced accordingly.

CALCULATING THE MAXIMUM SYSTEM VOLUME

The system **volume** limits how frequently the pool can be filtered by a given size of filter running at a particular flow rate. In a very lightly stocked goldfish pool with plants and with very high levels of ultra violet (UV) treatment to control green water algae, the maximum volume treated by a filter may be as much as three to four times the hourly flow volume through the filter. However, in lightly stocked koi ponds, the maximum volume treated is around 3 times the hourly flow volume through the filter ((1) on the table). For more typical koi pond loading situations the volume treated should not exceed twice the hourly flow volume through the filter ((2) on the table). In commercial stock tank situations which are very heavily loaded, this volume may need to be reduced still further and extra aeration provided.

FILTER SIZE IS RELATED TO POOL VOLUME **AND** FISH STOCKS

Take into consideration both the volume of the system **and** the weight of fish when choosing the correct filter. Remember that flow from the pump will fall as the filter starts to gather dirt and the pump strainer starts to clog. Therefore, when calculating the size of filter required, the flow rates used should reflect typical pump outputs when running through a moderately dirty filter rather than the maximum flows found on new pumps running on newly cleaned filters.

It has been found that a BubbleBead filter of larger size than required, will not necessarily perform any better on a given pond but should require less frequent backwashing and have a larger safety factor[2]. So, if in doubt, move up to the next size of filter.

The correct size of pump

Pump size is related both to the volume it pumps **and** the pressure with which it pumps. The pumping volumes to aim for are listed on the table on page 11.

MINIMUM PRESSURES:

There is typically a loss of pressure across the bead bed of around 0.07 to 0.14 bar (equivalent to 0.7 to 1.4 metres of head / 1 to 2 psi) especially as the filter approaches the time for backwash. Even pumps with a relatively

low maximum head (3 metres) have been used successfully on the smaller models. Where the return feed to the pond is at a relatively low height, the effective running head is reduced even if the filter itself is at a high level. However, the pump still needs to have sufficient head to completely fill the filter when the pump is first switched on. In general we recommend pumps which have a rated head of at least 4.5 metres (14 feet).

MAXIMUM PRESSURES:

The filter hull itself has a maximum pressure rating. On filter models 3,5,7 & 9 this rating is 1.5 bar (21 psi) equivalent to a head of 15 metres, and it should never be exceeded. Take care if you use a high pressure pump (e.g. a powerful swimming pool pump) as these may exceed the pressure rating. Even if the combined suction/delivery head quoted is below 15 metres, such pumps can give high pressure surges when started. Therefore, for all pumps with a quoted head exceeding 10 metres we consider it **essential** to use a bypass tee before the filter inlet, with a pressure regulating spring-check-valve to prevent excess pressures building on the filter. (Appendix Four). A pressure gauge is also strongly recommended in such situations.

Some swimming pool pumps are not designed to be run at low pressures or low heads. As the pressure through a BubbleBead filter may drop as low as 0.15 – 0.20 bar (2-3 psi / 1.5 - 2.0 metre head equivalent) only use pumps whose recommended range drops this low.

PUMP OUTPUTS

The table overleaf gives suggested pump sizes in terms of maximum flow rates at a given head and the maximum head rating of the pump. When using a filter on a pond of less than the maximum capacity, reduce the flow rate accordingly. Your dealer should be able to recommend suitable models from the ranges available in your area. Remember that a small pump may not suit longer pipe runs or high head situations. If in doubt, it is better to have a slightly larger pump and use a valve on the pump, or a bypass to control excess flow, rather than to have a small pump which has no spare capacity. Surface mounted pumps should be of the self priming type or installed in a way that ensures they cannot run dry.

The minimum recommended flow through any filter is 25-30% of the maximum flow quoted. This flow should be sufficient to supply the filter organisms with the necessary oxygenated water for efficient filtration.

MODEL Model number refers to cubic feet of media	**Max. Pond Volume gallons** (litres) **(1)** - Light Stock 3 hr (Turnover) **(2)** - Standard 2 hr		**Max Koi load** 1% feed rate	**Max.Rec. FlowRate gph** (lpm)	Suggested Pump Size Pre-settlement or pre-straining is **essential** with solids handling pumps!	Recommended **U/V** for algae control* at standard pond volume in full sun
BBF-3 1.70m high 0.79m dia.	**7500** 34000	**5000** 22500	**150 lbs.** 65 Kg	**2500** 190	The maximum head of the pump should be at least 2.5 metres more than the working head or exceed 4.5 metres, whichever is the higher figure.	**55w** Alternatives 2 x 30w 4 x 11w PL
BBF-5 1.95m high 0.79m dia.	**12000** 55000	**8000** 36000	**250 lbs.** 110 Kg	**4000** 300		**2 x 55w** Alternatives 3 x 30w or 3 x 36w PL
BBF-7 2.25m high 0.79m dia.	**16500** 75000	**11000** 50000	**350 lbs.** 150 Kg	**5600** 425	The maximum head of the pump should be at least 2.5 metres more than the working head or exceed 5.0 metres, whichever is the higher figure.	**3 x 55w** Alternative 5 x 30w
BBF-9 2.5m high 0.79m dia.	**22000** 100000	**14500** 66000	**450 lbs.** 200 Kg	**7200** 550		**4 x 55w** Alternative 6 x 30w

N.B. A pressure release bypass is essential if using high pressure pumps rated at 1.0 bar or over !
e.g. rated with a combined suction & delivery head exceeding 10m. The filter pressure rating is 1.5 bar max. (See p.52)
Gallons are imperial. Multiply by 1.2 for US Gallons. *For control of parasites etc., much higher levels of UV are required.

ELECTRICAL SAFETY

Like all electrical equipment around the pond, the pump should be correctly installed and fitted with a safety circuit breaker (RCD). The RCD should be of the latching type that does not require resetting after a powercut. Some types may be too sensitive to the power surges caused by turning the pump on and off. In these cases a less sensitive RCD may need to be fitted – contact your local electrician for advice.

STRAINERS

BubbleBead filters contain an internal inlet screen with slots of 1.7 to 2 mm spacing designed to capture large solids whilst preventing loss of beads. The backwash process cleans these screens, but the rate of internal screen clogging will be reduced if solids of greater than 2 mm and strands of blanketweed are removed before being pumped to the filter. This also greatly reduces shuttle valve maintenance. It is therefore very important to **fit an appropriate strainer to the pump inlet** (See Appendix Two). Very fine additional strainers (e.g. open-cell foam blocks) are neither necessary nor desirable, unless specified by pump manufacturers.

The correct size of ultra violet (UV) unit

A UV unit is the most useful ancillary equipment to use with a BubbleBead filter as it helps to control the smallest (< 5 micron) free floating algae and blooms of bacteria which are too small to be readily captured by the filter.

Closed chamber type UVs (with a protective quartz sleeve for the lamp) are recommended. An external UV unit can be easily plumbed into the return pipe. Despite small differences in design, the major factor in most UV unit performance is the wattage of the lamp. See the preceding table for the correct size for green water control. Where the pond is heavily shaded, control may be achieved with 50% of the wattages listed. In very shallow ponds and in more southerly areas where sunlight intensity is higher, a higher wattage of UV light may be required. A **much** higher wattage is required for sterilization of parasites and other pathogens.

Maintain the UV unit as recommended by the manufacturer. Choose a unit with wide bore connections, rated for flows in excess of the maximum filter flow, so as to prevent back-pressure across the UV. In some cases it may be necessary to use two or more external units **in parallel**.

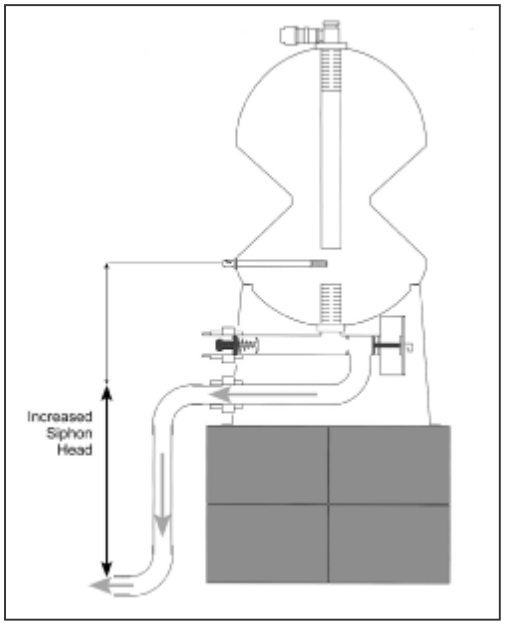
Siting the filter

THE FILTER BASE

The filter needs to be mounted on a firm level base. The units are heavy when full of water and **must** be adequately supported for safety. All models should be positioned on a level, purpose made slabbed area or concrete plinth. The inlet to the filter should ideally be above the level of the water in the pond (See page 50). It is necessary to periodically check the valve assemblies (see page 32) - the fittings at the base and top of the filter should be readily accessible and **not** permanently boxed in. Avoid drilling multiple holes in the base as these can weaken it.

THE SIPHON HEAD

The efficiency of the backwash cleaning process is directly related to the speed with which water drains through the waste outlet. This is related to the 'siphon head' (see diagram) between the filter waste outlet and the air strainer inlet to the filter.



This distance is over 30 cm on the filters as supplied, which is adequate in most circumstances. However, by simply raising the filter on a plinth built from one or two courses of standard building blocks and adding an extension pipe, the siphon head is increased and the efficiency of backwash greatly improved.

THE OUTLET PIPES

The backwash efficiency is also related to the waste outlet pipe size and fittings. Ideally use pipe of 2" or 2½" (nominal) for the horizontal runs and use the minimum number of bends (swept elbows not knuckle bends). More narrow pipes will **significantly** reduce the efficiency of the filter system! The very final section of pipe, whether a vertical or horizontal drop, should use slightly smaller pipe (e.g. 63mm reducing to 50mm. If you are using hose, fit a slight restriction fitting at the pipe end). This slight restriction ensures that when the filter is drained, the entire pipe fills with water, driving out air and starting a **siphon action** which helps to suck dirt from the filter. A relatively long horizontal outlet in solid pipe encourages this siphon action and is an ideal alternative especially where raising the filter is not feasible. Avoid excessive lengths of undulating hose as this can encourage airlocks. The waste outlet fittings have an important effect on the efficiency of the filter backwash and overall filter function. Ask your dealer if you are in any doubt about how to plumb in your filter.

DISTANCE FROM THE POND AND FROM YOUR DRAINS

The filter can be some distance from the pond, but a larger pump may be required to overcome the friction loss in the longer inlet pipework. The filter should be relatively close to your drainage system or soak-away for ease of waste water disposal. If this is not possible the option shown on page 24 may be helpful.

OUTSIDE OR UNDER COVER?

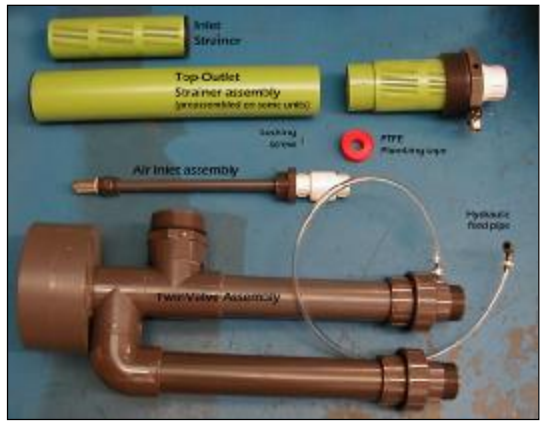
The filters are suited to outdoor use but if sited in an outhouse, shed or garage, they will not only be out of sight from the pond but also better protected from severe frosts (see the Winter Running section – page 34).

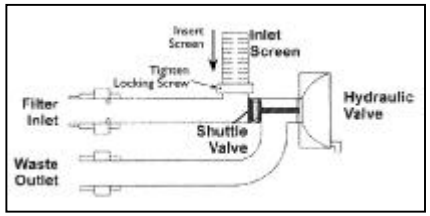
Assembling your BubbleBead Filter

The filter is supplied with some parts assembled. Check that you have all the relevant parts before commencing. You would be wise to complete reading this guide before you start the final positioning of the filter.

The parts provided are:
- Main filter body;
- Filter Stand;
- Inlet Strainer;
- Top-outlet strainer assembly & locking screw;
- Air inlet assembly;
- Main TwinValve assembly;
- PTFE plumbing tape;
- Bead media.

Ensure all parts are present. Contact your dealer immediately if anything is missing or damaged.



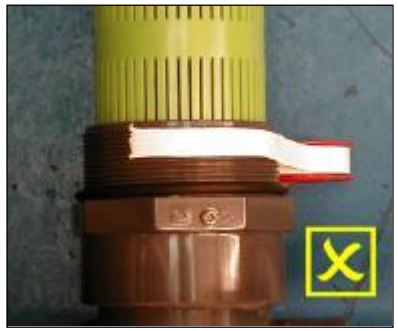


1) For the TwinValve Assembly, remove the small locking screw and wrap it with a small piece of PTFE tape. Insert the open end of the inlet screen into the large opening on the top arm of the assembly. Insert and tighten the locking screw ensuring that the inlet strainer is held in place.

2) Prepare all the threaded fittings (the top-outlet assembly, the thread on the main valve assembly - situated below the inlet screen ((**A**) below), and on the air inlet assembly), by wrapping with PTFE tape.

Tips for inserting threaded fittings

With the insertion end of the male fitting facing you, tightly wrap the P.T.F.E. tape on in a clockwise direction. If the tape is wound on in the wrong direction it will tend to peel off as the fitting is screwed in.

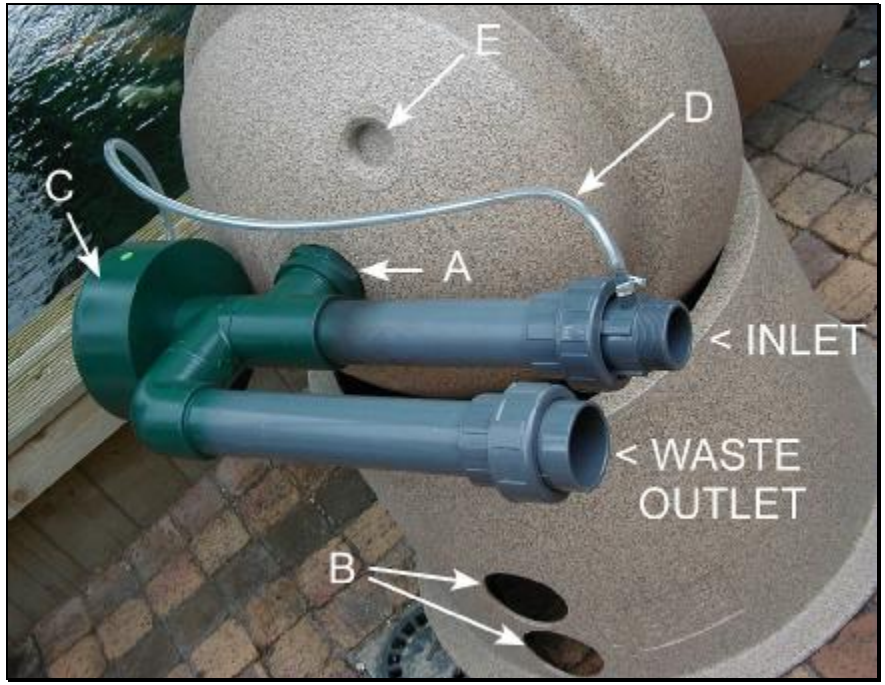


Gently brush out the threads on the female fitting to ensure that they are clean and free from debris. Align the male and female threads carefully to avoid cross threading. Whilst exerting slight pressure, turn the assembly counter-clockwise a half turn or so, until the threads align. Now screw the male fitting clockwise by hand, continuing to take care to avoid cross-threading. If the fitting does not appear to be threading in correctly, carefully remove it and start again. Applying silicone lubricating spray to the female threads can often make the threading process more easy.

Take your time and do not rush this procedure

Only use tools (e.g. belt wrenches) to tighten fittings once they have started to thread in correctly. Do not use tools which might damage the threads or the fittings and avoid using projecting pipework as a lever. **Never** overtighten or force fittings otherwise you will damage them.

3) If there is enough room to work, place the filter stand in its final position. It is safer to have **two people** to help handle and move the filter in this and the following stages. Rest the main filter body on its side on the filter stand with the lower (expansion) chamber over the centre of the filter stand (see picture).



This shows the filter rested on its side with the lower (expansion) chamber over the filter stand. A = Joint between TwinValve assembly and the lower screen fitting in the filter.
B = The holes cut in the filter stand for the inlet and waste outlet to protrude through.
C = The hydraulic valve (sealed control unit) and (D) hydraulic valve feed pipe.
E = The blanked-off fitting for the optional additional drain valve (see page XX).

4) Screw the main valve assembly into the base of the filter housing (A) taking great care to avoid cross-threading. On units fitted with an 'O' ring, continue to tighten the fitting until the 'O' ring is compressed by the

filter body. If the assembly will not turn further by hand, or the hydraulic valve casing touches the filter body – stop. Do **not** turn an extra half turn. **Do not overtighten the fittings!**

5) Temporarily disconnect the dismountable couplings from the inlet and waste-outlet on the TwinValve system. The upper coupling (with the hydraulic valve feed pipe) is the inlet, the lower is the waste water outlet.

6) The end of the hydraulic feed pipe with a hosetail elbow should have PTFE wound around the threads before it is threaded into the hydraulic valve. Hand tighten and leave in a downward position (with respect to the final mounting). Check that the clips at each end of the hydraulic feed pipe are tight, and that the pipe is not kinked or pinched.

The entry point into the valve may be central (as shown here), or offset towards the base.

6) If you wish to fit the optional additional drain valve this is an ideal time. The entry point for this fitting ((**E**) on page 16) is supplied blanked off. Following the directions on page 37, cut the hole out and screw in a 1½" BSP hosetail using PTFE on the threads. Link the hosetail to a pipe and valve.

7) This stage is easier with two people! Lift the main filter body to allow the coupling carrying the hydraulic feed pipe to be threaded through the **lower** hole cut in the filter stand. Gently ease the filter to an upright position, whilst guiding the inlet and waste outlet to the openings cut in the foot support.

8) The inlet and outlet should now be protruding from the two holes in the filter base and the lip in the main filter body should be resting evenly on the base. Check that the shuttle valve is in place in the inlet pipe and reconnect the dismountable couplings.

The coupling with the hydraulic feed tube screwed into its side is threaded onto the **upper** outlet. The hose has been fed through the lower hole to reduce kinking.

9) The air inlet should be positioned. (Filters for marine use should have the stainless strainer (and brass valve option - if fitted), replaced with a plastic one (ask your dealer)). On units with a white flapper valve, this should be glued onto the grey fitting, ensuring that the flow direction is **into** the filter (so the flap can be lifted by pushing in from the outside end).

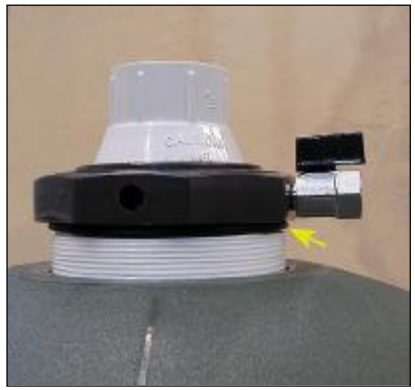
Screw the fitting into the side of the filter body taking care to avoid cross threading. Hand tighten and leave the bulge on the white flapper valve uppermost, marked: HORIZONTAL USE - THIS SIDE UP.

10) If the filter stand has not already been sited in its final position, move the entire filter to its final working position on a firm level base. Ensure that the inlet/outlets at the base and top are still readily accessible for maintenance, and that there is sufficient room left for connecting pipes.

11) Fill the filter with the supplied beads, through the top opening in the main filter body. Do not add more beads than the filter is designed to hold. It can be useful to use a wide funnel at this point to avoid losing beads. Only use genuine BubbleBead Media to prevent clogging of the strainers or valve assemblies. Use of inappropriate media will void your guarantee.

12) If the outlet assembly is not pre-assembled, push the extension tube onto the spigot by the strainer, ensuring that there is no gap left. The extension is held in place with the stainless screw which should be firmly screwed into place through the pre-drilled pilot hole. (Pre-assembled units are glued and do not require this screw).

The small metal venturi valve in the side of the top fitting should be removed, the threads wound with PTFE tape, and then screwed back in. Hand tighten, so as to leave the tap uppermost. (Venturi use, page 44).



Wind PTFE tape generously onto the thread of the top-outlet assembly. Check that the 'O' ring (supplied on filters from 2002) is in place in the cut-out groove (arrowed). Lower the assembly into the filter taking great care to align it vertically. Screw this fitting in by hand at first. Tighten using the hexagonal section as a grip, either with a belt wrench (as shown) or a specific tool that fits into the recesses pre-drilled in the hexagonal fitting. On models fitted with an 'O' ring, continue to tighten the assembly until the 'O' ring is compressed by the filter body. Do **not** tighten further! Do **not** use the venturi valve as a lever to tighten the assembly!

Plumbing in

The **top outlet** of the filter should be plumbed using solvent weld fittings. One option is shown here. Use wide bore bends. Swept 90° or 2 x 45° bends are preferable to knuckle bends. For ease of future maintenance it is **essential** to fit a dismountable union close to the filter. The union can join onto further lengths of solvent pipe or onto a hosetail (as shown), for connection to reinforced hose. Trim multi-fit

hosetails to the largest hose possible. Narrow hoses reduce filter efficiency and create undesirable backpressure.

All pipework **must** be fully supported so that it does **not** put undue strain on the fittings. Also see the plumbing tips below.

The **filter inlet** and **waste outlet** can be plumbed in various ways. The option shown here is a dismountable hosetail on the inlet and a socket union to solvent pipe on the outlet.

Pipework

Plumbing to and from the filter can be carried out using solid or semi-flexible swimming pool pipe with glued fittings, **or** using reinforced flexible PVC hose and hosetails with threaded or glued fittings. If you are using flexible hose, ensure that it is a heavy duty, smooth bore type rated for well over the pressures likely to be found in the system (e.g. over 4 bar/60 psi). Use fully opaque hose to prevent algae growth on the inside wall of the hose - this can rapidly reduce flow rates as well as looking unsightly.

Plumbing tips:

TO MINIMISE PRESSURE LOSS ON THE INLET
AND BACKPRESSURE ON THE OUTLETS:

- use larger bore pipe/hose wherever an option is possible
- all pipe fittings (including UVs) must be as large bore as possible
- avoid fittings with internal restrictions.
- avoid using valves on the outlet! (see Appendix Four).
- consider swept rather than knuckle bends and keep bends to a minimum.

TO PREVENT STRAIN ON THE FILTER INLET/OUTLET FITTINGS:

- **support pipework** with pipe-clips etc.
- **avoid the weight of pumps or external UVs being carried by the inlet/outlet fittings.** Failure to note this could void your guarantee.

TO PREVENT LEAKS OF WATER OUT, OR AIR IN:

- use PTFE plumbers tape on **all** threaded fittings.
- use solvent cleaner on any solvent-weld fittings before use and use ample amounts of an appropriate glue. It is best to set up solvent fittings in a 'dry run' to check all positionings **before** final gluing takes place.
- use correctly sized hosetails and appropriate hose clips. If the hose is slightly loose on the hosetail, run a strip of silicone sealant around the hosetail before fitting the hose and clamping down. Clips can distort hose causing leaks if over-tightened. TIP: To reduce this risk, wrap the end of the hose with a single layer strip of rubber liner before fitting the clip.

TO SIMPLIFY FUTURE MAINTENANCE:

- use good quality dismountable connections on the pump, filter outlet, and any external UV unit, e.g. female 'nut and liner' hosetails, or dismountable unions, or bayonet fittings (see right) with an 'o' ring seal

- use sufficient flexible hose on submersible pump outlets
- keep external UVs and valves accessible.

TO PREVENT EXCESS PUMP VIBRATION:

- use a length of flexible hose in the outlet pipework from surface mounted pumps.

TO AVOID CORROSION OR POISONING PROBLEMS:

- try to avoid metal fittings
- if metal parts are used, choose quality materials e.g. (316) stainless steel.

TO MONITOR THE PRESSURE IN THE SYSTEM:

- if a high pressure pump is being used, fit a pressure gauge just before the filter inlet. This is **strongly recommended** for pumps with over 10m (33ft) head. It is also useful in heavily loaded aquaculture systems to monitor the rate of solids collection within the filter. On systems fitted with a high pressure pump, or where filters are feeding manifold or valved outlets, it is essential to fit a pressure release bypass (see Appendix Four).

Important points

AIR BREAKS AND UNDERPRESSURE

If the outlet on the main return pipe to the pond is below the level of the air inlet checkvalve on the filter, there is a slight risk of siphoning occurring. This is more prevalent on new/clean filters, with relatively low pressure pumps and wide bore piping on the return to the pond. There are two side effects on filter performance if siphoning occurs:

- Air can be drawn into the filter through the air inlet during normal running (especially with lower pump flow rates). These bubbles can disrupt the filter media causing water cloudiness and a dripping air inlet.

- The resultant lower pressure inside the filter body results in turn in a lower pressure (underpressure) in the hydraulic feed pipe. As a result the hydraulic valve may not close completely and may dribble. (see page 43)

Higher return outlets (e.g. to a cascade), avoid this risk. Ideally, the return pipe to the pond should enter above water level to create an air break. This reduces the risk of such siphoning and also aids aeration of water returning to the pool. The venturi valve on the top filter outlet can also be used to provide aeration and overcome underpressure (see page 44).

AERATION OF FILTERED WATER RETURNED TO THE POND

Koi pond water **must** be aerated at some point as both the koi and the filter bacteria can consume high amounts of oxygen, especially in warm weather. Returns that encourage some re-aeration of the water are strongly recommended, e.g. cascades. Venturi devices in the pond are an option but some create a great deal of undesirable backpressure whilst others can encourage the underpressure noted above. Use the filter's integral venturi instead (see page 44).

THE WASTE OUTLET

Any pipe or hose connected to the **waste outlet** should be wide bore and should flow horizontally or slightly downhill to a drain or sump area to encourage rapid draining of the filter (see also the section on siting on page 12). Where there are undulations in the pipe, air-locks can occur,

though having an air break at the end of this pipe can reduce this. In other cases the pipe can empty below water surface if required.

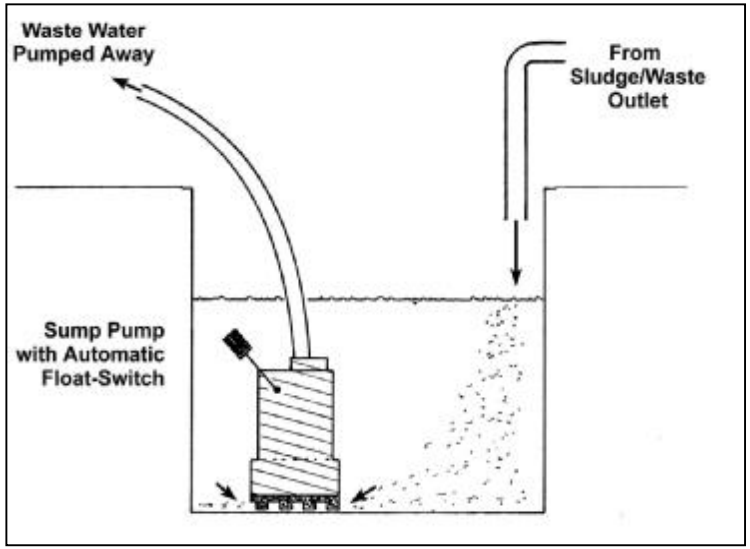
NON-RETURN VALVES / FOOTVALVES

To prevent certain pumps losing their prime, manufacturers may recommend that a non-return valve (or footvalve) is situated before by the pump. As the shuttle valve acts as a non-return valve, any additional footvalve should **not** be used - it will prevent the correct operation of the shuttle and hydraulic valves. Consider alternative means of maintaining prime e.g. site pumps on a level below that of the water level in the pond.

Dealing with waste water

Waste water leaves the filter at a rapid rate. Check that your drains or soakaway can cope with this surge. Waste water is high in solids and organic waste and must not be emptied directly into natural water bodies. You may need permission to direct this waste into public sewers.

Provided salt or chemicals have not been used in the pond it should be safe to use this waste water to irrigate garden plants, indeed the waste will have a beneficial fertilizing effect. To avoid restricting the flow of waste from the filter, avoid long irrigation hoses and use a separate sump and sump pump as shown below.



Using a pump to dispose of waste water

Starting the filter for the first time

Start up the pump, do not turn on UVs at this stage. Check for leaks. If any of the threaded fittings leak, and gentle tightening does not help, the filter will need to be drained, the offending fitting removed and rewound with extra PTFE tape before refitting. Do not attempt to seal such leaks by smearing the outside of the filter with sealant, glue, mastic or repair compounds. This rarely solves the problem, it may make future dismantling difficult or impossible, and damage the filter body - voiding your guarantee.

The waste outlet may dribble slightly until the hydraulic valve has completely closed, this usually takes 15-60 seconds. However, on new filters the membrane in the hydraulic valve can be more stiff and may take longer to stretch and move the valve to the closed position.

STRETCHING THE HYDRAULIC MEMBRANE

If the waste outlet continues to dribble after a minute or two, the membrane inside the hydraulic valve can be stretched further by temporarily placing your hand over the water return to the pond. This increases the pressure inside the filter, the filter inlet pipe, and the hydraulic valve feed pipe. This will close the valve over a period of a minute. This procedure is normally only necessary on new filters or where the hydraulic valve has not been used for some time. Also check that the hydraulic feed pipe is not clogged or kinked in any way.

As the filter fills, the beads will rattle against the side of the filter body but the noise will stop once the filter is full. On this first time of running you may wish to direct the first few gallons of water to waste as they flush out any dust from the pipework and beads. If there are no leaks and water output is flowing evenly, your BubbleBead filter is operating properly.

It is a good idea to measure the flow rate of water returning to the pond. Use a graduated bucket and stopwatch to calculate the flow rate. Adjust the flow rate as required by using a flow regulator on the pump outlet. Do **not** fit flow regulators on the filter outlet (see Appendix Four).

If you have fitted a pressure gauge, note the typical pressure on the dial and make a note of it in a space on page 55.

THE TRIAL BACKWASH

Now is a good time to carry out a **trial backwash cycle**.

1. Turn off the pump. The shuttle valve will move to the drain position with a 'clunk', the top-outlet checkvalve will close by itself and the hydraulic valve will begin to open, releasing water to the waste outlet.

2. Immediately, make a note of the time or use a stopwatch. Put your ear to the side of the filter and **listen**. Air is sucked into the filter through the air inlet check-valve. As beads tumble clean in the cascade of air bubbles they rattle against the side of the filter body. Allow the filter to drain down completely. This first time, the water from the waste valve should be no more dirty than the pond water itself. Listening to the unit lets you hear how a normal backwash should sound.

3. As soon as the flow from the waste outlet drops to a trickle, make a note of the time or turn off your stopwatch. The time taken to drain the filter is representative of the minimum time that your filter is likely to take for a backwash cycle and will act as a benchmark to compare with in future. Note this time in the space on page 55. This time also guides you on the very minimum amount of time that the filter pump should be turned off for the backwash to take place. Partial backwashes are **not** recommended. Always allow time for the filter to fully drain.

4. Restart the pump. Note the time taken for the filter to refill. This will also act as a benchmark for the future as it gives an indication of the cleanliness of the strainer on your pump and the screen in the filter inlet. Note this time also in the space on page 55. Remember that the waste outlet may trickle for a short while until the hydraulic valve is fully closed.

Your filter is now tested and operating correctly.

Running-in your filter

Apart from backwashes, your filter should run 24 hours a day to support the biological organisms that will colonise the filter media; just like your fish they need oxygen to survive.

Mechanical filtration starts almost straight away, but it can take up to three months for full biological activity to mature, especially in brand new ponds and in cold weather. Patience is necessary during this phase. If there are no fish in the pond, commercial additives are available that contain ammonium salts and nitrites that imitate fish waste and help the filter to mature. Otherwise, there are a number of steps that you can take to aid the maturing process:

1) Do not immediately introduce large numbers of fish. Build up fish stocks gradually using hardy fish of lower value to begin with.

2) Feed fish more lightly than normal in the first two months.

3) After the first few days of operation, add a commercial filter seeding agent that contains filter bacteria. Alternatively swill out the debris from an existing active pond filter and pour it into the pond near the pump intake.

4) Avoid the use of pond medications during the filter maturing period. Some medications can severely disrupt filter organisms and many medications can temporarily reduce filter activity, especially on the first time of use. If in doubt ask a specialist before using any treatments.

5) Avoid turning on UV units during the first month. The water may green temporarily but this is rarely harmful.

You can monitor the maturing process by using standard pond test kits. The most useful ones at this stage are pH, nitrite (NO_2), ammonia/ammonium (NH_3/NH_4) and nitrate (NO_3).

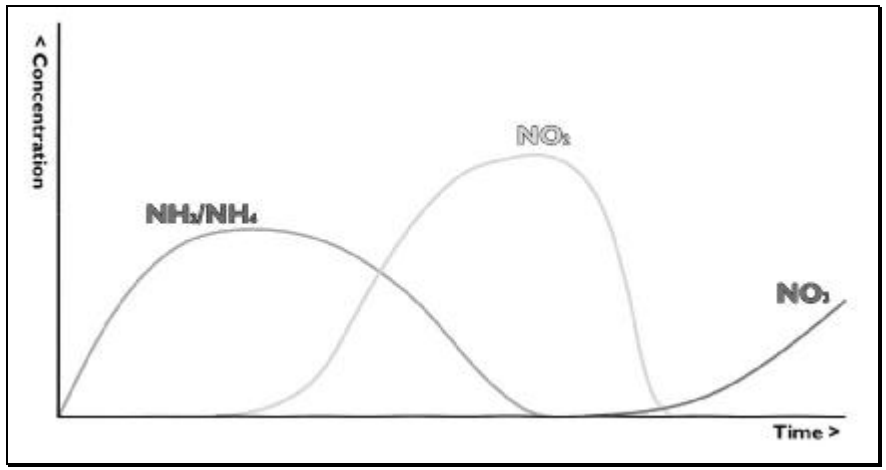
The pH should remain relatively stable and need only be checked occasionally at this stage. Typically, acceptable pond pH values range from 6.5 to 9.0 with the ideal range for pondfish being between 7.0 and 8.5.

ESTABLISHING NITRIFICATION

The major soluble waste product produced by fish is ammonia and its ammonium salts, and this is the first product to build up in the water. Bacteria that break down organic wastes and uneaten food also add to the levels of ammonia in the water. Within a week or two (in a few days in warm weather), specific bacteria that feed on ammonia start to build up on

the surfaces of the beads in the filter, and they begin to break the ammonia down into nitrites. As the nitrite levels become more detectable in the water, the ammonia levels usually start to fall. Finally, other specific bacteria increase in numbers to feed on the nitrites converting them to nitrates. The whole process that results in the breakdown of these nitrogen containing products is known as **nitrification** and the fluctuations in these waste products typically follows the pattern illustrated in the adjacent graph.

TYPICAL WATER QUALITY DURING FILTER MATURATION



Ammonia (NH_3/NH_4) and nitrite (NO_2) are both stressful to fish, and whilst they are present in the water, new additions of fish should be avoided. Once the filter has matured sufficiently, these two waste products should be reduced to below detectable levels and only the more benign nitrate (NO_3) may be detectable. However, a sudden increase in loading at any stage (with fish or fish food) may overwhelm the filter resulting in a reappearance of ammonia and nitrite until the filter bacteria can increase in numbers to cope.

If ammonia or nitrite appear in the water after the maturing period it can suggest problems, and these are dealt with in the Troubleshooting section on Water Quality in this guide (page 38).

When to backwash the BubbleBead filter

During the maturing period, whilst new ponds are relatively free of waste, the filter will take some time to become dirty. The delicate film that supports the growing filter bacteria will also begin to form on the surface of the beads. In order to avoid disrupting the bacteria at this crucial early stage, avoid backwashing the filter for two to four weeks, especially in ponds with clean water. The major sign that a backwash is necessary is when there is a notable drop in the flow from the filter outlet. Check that this is not merely due to the strainer on the pump becoming clogged.

If the flow has dropped to around a half to two thirds of the initial rate, (or the inlet pressure gauge, where fitted, has risen to 1.4 psi / 0.1 bar above the typical level when clean) then the backwash procedure **must** be carried out.

THE STANDARD BACKWASH CYCLE IS AS FOLLOWS:

1. Turn off the pump. The shuttle valve will move to the drain position with a 'clunk', the top-outlet checkvalve will close and the hydraulic valve will start to open, releasing water to the waste outlet.

2. Air will be sucked into the filter through the air inlet check-valve. Remember to listen for typical sounds as the beads tumble clean in the cascade of air bubbles. Observe the waste water. Large particles caught by the bottom screen will flush out first; dirt trapped by the beads will wash out near the end of the flush. For best results allow the filter to drain down completely.

3. As soon as the flow drops to a trickle from the drain, you can restart the pump. Remember that the waste outlet may continue to trickle for a short while until the hydraulic valve is fully closed. Fortunately, this helps to flush sediment from the pipework.

4. It is quite normal for the first few gallons of water from the filter top-outlet to the pond to be a little cloudy. This is not harmful and the filter will soon remove these particles and maintain the clarity of the pool. It makes sense not to carry out a backwash immediately before any important viewing of the pond. (See page 43 for further comments).

After this first backwash the standard backwash frequencies **must** be implemented. Once established, the beneficial bacteria on the surface of the beads can withstand numerous backwash cycles without any major disruption of nitrification. Indeed, tests have shown that the gentle bubble-wash actually improves the efficiency of nitrification by the filter bacteria.

The Recommended minimum backwash cycles for your model:

MODEL	MINIMUM BACKWASH FREQUENCY			Typical Backwash Water Loss (approximate)
	Winter < 10 degC	Spring & Autumn	Summer	
BBF - 3	Once or Twice Weekly	Twice Weekly	Every One to Two Days	45 Gallons 210 Litres
BBF - 5	Once or Twice Weekly	Twice Weekly	Every One to Two Days	60 Gallons 280 Litres
BBF - 7	Once or Twice Weekly	Twice Weekly	Three to Four times a Week	75 Gallons 340 Litres
BBF - 9	Once or Twice Weekly	Twice Weekly	Three to Four times a Week	88 Gallons 400 Litres

A series of extra backwashes once per month, reduces long-term maintenance (see p.32). On automated systems a backwash once or twice a day gives ultimate filter performance.

Regular backwashing flushes out solid wastes before they break down and pollute the water. Also, by removing wastes at this stage, nutrients are removed from the water and the growth of algae can be reduced further. The process keeps the filter at maximum biological efficiency and minimises the need for any other maintenance. Regular backwashing is essential in heavy loading situations. On aquaculture systems the filter can be set to backwash every few hours if required. You simply cannot backwash a BubbleBead filter too often.

Making the backwash fully automatic

Manual backwashing by turning off the pump is easy enough, but does not make full use of the automatic potential of the filter. Make the whole process **fully automatic** by wiring the pump through an appropriate timer, and ensuring that the pond is topped up e.g. through a float valve. In this case it is best to set the filter to backwash at least once per day.

FITTING A TIMER

The pump electrical supply is wired into a timer designed to turn the pump off for around 10 minutes at desired intervals. The timer should be capable of handling the start-up surge current of the pump. As a very rough guide allow for around eight times the normal running current of the pump, e.g. for a pump rated at 1 amp allow for a start-up surge of around 8 amps – Immersion heater timers are often suitable. For large pumps a special starter gear may be required, check with your electrician. The timer should ideally be able to be set for intervals in minutes, and have a battery backup to retain the time in the event of power cuts.

In the event of a power cut, a backwash cycle will take place leaving the filter hull empty of water. Filter bacteria will be able to survive for many hours (if not days) on the moist beads due to the relatively high oxygen levels in the empty filter. This gives BubbleBead filters a **major** advantage over typical submerged bed filters.

Check in normal running that pool water does not siphon from the pond during a filter backwash or power cut.

FITTING A TOP-UP VALVE

A standard cistern ballcock valve, 'Torbeck' valve or similar can be used to top up the pond automatically, making up for water lost through the filter backwash and from normal evaporation. To prevent fouling of the valve, and disruption from small waves, it is common to place this in a separate cistern mounted at pond level and connected through the side of the pond with a link pipe. To meet water board requirements it is usually necessary to fit a double-check valve in the supply line, to prevent siphoning of pool water into the mains water supply in the event of pressure drop. Some authorities also require such water use to be metered.

Where only small quantities of water are being added in a day (1 to 2% of pond volume) the dangers from chlorine in the water are minimal. Where larger volumes are being added, or if there are particular worries regarding tap water quality (e.g. metal content) it may be wise to use an appropriate water conditioner or to fit a tap-water purifier in the feed pipe. This make-up water, following backwashes, can add up to a valuable portion of the water changes required in any system stocked with numbers of fish.

Long term maintenance

MONITORING

It is **very important** to periodically monitor the backwash operation:

- listen to the beads sloshing in the filter

- check the backwash time and the action of the valves.

Aim to monitor this operation at least once per week, especially if it is normally controlled by a timer rather than manually. This will show up any possible problems before they become serious.

MONTHLY EXTRA BACKWASHES

We recommend that once a month the backwash process is carried out three to five times in a row. This dislodges any more persistent wastes that may have collected in the filter. On heavily loaded aquaculture systems this procedure can be carried out every one to two weeks.

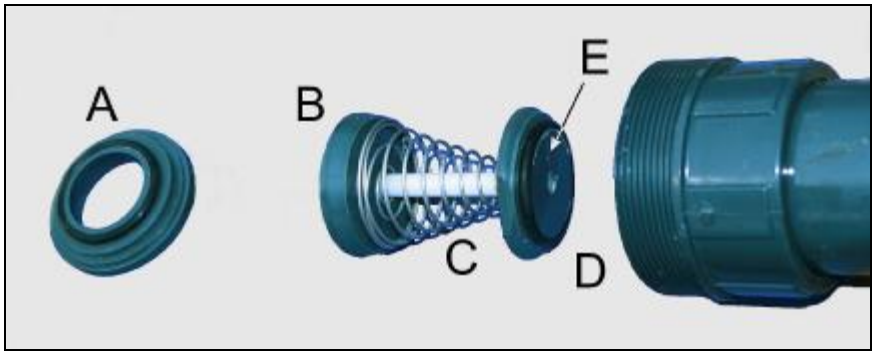
VALVE MAINTENANCE

The correct functioning of the valves in your filter is crucial for the safe running of the filter system. The shuttle valve should be inspected and cleaned at least monthly; this should take less than ten minutes.

CLEANING THE SHUTTLE AND HYDRAULIC VALVES

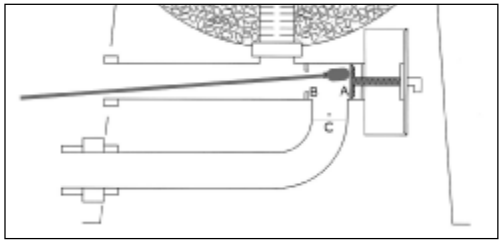
To clean the shuttle valve, turn off the pump immediately following the standard backwash cycle, whilst the filter is empty of water and the shuttle valve is in the 'drain' position. Completely remove the dismountable union on the filter inlet to reveal the end of the shuttle valve. The shuttle valve can then be removed from the inlet pipework. Clean off any blanketweed or debris clinging to the spring, or on the front plate of the shuttle, or on the valve seat in the dismountable union. On those shuttle valves fitted with a vent (E) in the front plate, check that this is clear of debris (see picture overleaf).

Whilst the shuttle valve is removed it is possible to check the hydraulic valve. (The hydraulic valve control mechanism is a sealed unit and is not user repairable.)



A = Shuttle valve seat with 'o' ring*. B = Shuttle valve with, (C) Spring; (D) Front plate with 'o' ring*; and (E) pressure release vent*. (*'o'rings/vent only on early models)

The hydraulic valve feed pipe (see picture on page 16) should be checked. It should be unkinked and free of debris, and the entry point to the pipe also kept clear of debris. The facing plate (A), of the hydraulic valve can be cleaned by inserting a stick with a fixed brush or sponge into the inlet pipe. Clean the valve seat (B) at the same time.



In the rare likelihood that the hydraulic valve action needs to be checked, the hydraulic valve feed pipe should be disconnected from the inlet pipe. Whilst **gently** blowing into this pipe, the movement of the hydraulic valve can be checked for with a long (70 cm) cane inserted into the inlet pipe and held against the valve facing plate (A). (If the valve does not close properly, see page 44). After cleaning, replace the shuttle valve and reconnect any pipework before restarting the pump.

If something becomes lodged in this region, it is possible to remove the lower arm to get closer access to (A) by removing the locking screw (C) on the lower arm and easing the arm off (This dismountable section is only found on models produced from 2002 onwards). Take care not to lose the sealing 'O' ring. Wrap the locking screw with a single layer of PTFE on reassembly to make it more easy to screw in. See page 44 for maintenance hints on the valve system.

CHECKVALVES

The top-outlet checkvalve and air inlet checkvalve are low maintenance items. Very occasionally the facing or seating may need cleaned. If the air inlet drips, see the troubleshooting guide (page 43) and the section on air breaks and underpressure (page 23).

PUMP STRAINERS

Remember that the strainer on the pump will need to be cleaned from time to time. If this becomes clogged with debris or blanketweed the filter may not fill or drain correctly, and flow rates will be affected.

INLET AND OUTLET SCREENS

Over time, the filter inlet screen (or very rarely the outlet screen) may slowly clog with more persistent immoveable dirt, strands of algae, or snails. Periodic removal and cleaning of the screens may prove necessary in these cases, especially if too coarse a strainer is being used with the pump.

Using a suitable pre-strainer (page 11 & 47) and carrying out a regular series of extra backwashes (page 32) will minimise the need for maintenance to these screens. See the Filter Troubleshooting section for other details.

Winter Running

In the winter when temperatures are lower (below 8-10˚C), feeding rates for koi should be reduced and maintenance can be less frequent. To avoid chilling the fish in water currents, avoid drawing in water from the pool base and instead draw from 30-60 cm below the surface. Consider reducing the flow rate through the system – biological and filtering activity will still take place in the BubbleBead Filter even at a quarter to a third of maximum recommended flows.

Ice can damage your filter! Wherever penetrating frost may be a problem, insulate filter pipework; the filter; external UVs; and top-up valves and pipework. Take especial care of pipes where there is little water movement e.g. the waste pipe, hydraulic valve and feed pipe, and any extensions to the air inlet pipe. Standard closed-cell pipe insulation wrap

and hot-water-cylinder jackets can be used but make sure that they are kept **dry** for maximum insulation. As the filter is sealed, and produces no smells, it is often desirable to position it in a frost-free outhouse, garage or utility room. This gives additional protection from freezing even if the pump should stop due to power failure.

CLOSING THE FILTER DOWN AS AN OPTION

On smaller systems and in very cold climates, an option is to turn the filter off after the first severe frost and leave it clean and dry until the spring. To prepare it for winter carry out four backwashes in a row to leave the beads as clean as possible, and then leave the filter dry. Disconnect the pump from the inlet and leave the outlet completely open. Remove the shuttle valve and disconnect the hydraulic valve feed pipe. Blowing and sucking alternately on this pipe will help to flush most of the water out of the hydraulic valve control mechanism.

If you wish keep the filter bacteria alive in the winter, some of the beads can be stored in an aerated tank of water indoors, with small amounts of ammonia added occasionally to feed the bacteria. To transfer some or all of your beads to a separate filter you can disconnect the filter outlet pipe and completely remove the top outlet system including the strainer, fit alternative piping and pump the floating beads to a separate filter or store.

Water Quality Maintenance

The filter may have passed its initial maturing period, but biological filters continue to mature over months and years as different micro-organisms establish on the filter media. This maturing process can be set back by long power cuts or when pool treatments are used, especially for the first time.

PARTIAL WATER CHANGING

The water quality also continues to change due to the gradual build up of products in the water e.g. nitrates (NO_3) & dissolved solids. Conversely, some minerals may become depleted in the water as they are used up by the fish, plants and filter organisms. In lakes this aging process in the water body is offset by streams and heavy rains which bring in fresh water and new supplies of minerals, and flush out wastes that are building to excess. In a closed system like a koi pond it is necessary to carry out regular **partial water changes** to mimic these natural refreshing processes.

The backwash process loses some water which will need to be made up with new water added to the pond. This is most easily carried out with an automatic top-up valve. This waste removal and top-up acts as a partial water change. In a system running at close to maximum pool volume capacity, the lower recommended frequency of backwashing might only result in a water change of around 1% in a summer week. This level of water changing is much too low to maintain water quality in the long term and additional partial water changes will be necessary.

SET THE BACKWASH FREQUENCY TO WATER CHANGE FOR YOU

An easy option is to set the backwash frequency at a rate which will give the level of water change required per week, e.g. 5% per week in the summer is the rate used by many koi-keepers. The table (page 11) gives typical water loss per backwash. A high frequency of backwashing does not upset the filter organisms but actually improves filter efficiency.

Adding water to make up for evaporation is **not** equivalent to a water change, as this does not remove any waste products. Water needs to be removed from the pond e.g. through the backwash cycle; from a bottom drain; or with a pool vacuum; **before** water is added. Use a tap water conditioner or appropriate tap water filter to make large quantities of chlorinated water safe to add to the pond. Take advice from local

specialists if your source of water has chloramines, is direct from a borehole, or is high in metals such as iron.

MONITOR YOUR POND AND FISH TO AVOID PROBLEMS

Monitoring the general water appearance and the behaviour of fish is invaluable as a guide to water quality, but the only sure way to know is to carry out regular water quality checks. Use a range of good quality pond test kits as stocked by all major aquatic stores. By keeping a record of changes in water quality, problems can be avoided before they take hold, and the overall health of the fish and pool system maintained. The following troubleshooting guide to water quality is a summary to be used in conjunction with other sources of information on good fish husbandry. It is best to read through it **before** problems occur.

Extra advice for BubbleBead filters on aquaculture systems or in hot climates - The additional drain outlet

BubbleBead filters have now been in use in many different countries and have shown their ability to cope with a wide range of situations. In exceptionally hot climates where summer water temperatures regularly exceed 25° C (e.g. Southern states in the USA) it is possible for a dark sludge to build up on the base of the filter in longterm use, and standard backwash cycles may not remove all of this. This can also occur on aquaculture and grow-on systems where there is a constant heavy loading.

To pre-empt this, an additional drain valve can be fitted, using the 1½" BSP threaded socket built into the base of the filter, to the side of the inlet screen (see the pictures on pages 16-17). Normally this fitting is blanked off, but it can be opened up by removing the blanking plug (if fitted) or by using an appropriate cutting tool. Check with your dealer before attempting this to avoid breaching your filter warranty. A hosetail and short length of pressure hose (with clips) can be connected to this outlet, leading through a small round hole cut into the filter support, and a valve fitted on the end. 1" or 1¼" hose is usually adequate for this purpose.

This valve need only be turned on once a month for a few seconds. If necessary the waste can be run into a bucket and poured away. It is an **unscreened drain,** and should only be turned on when the filter is running **full** of water otherwise beads can be lost!

Water Quality Troubleshooting
Questions (?), Comments (▷), and Actions (▶)

▶ If **any** problems occur, carry out a full range of water quality tests.

? - Fish are hanging near, and/or mouthing at the water surface

▷ This can indicate a lack of oxygen entering the fish bloodstream. It may be due to low oxygen levels in the water or other problems with either water quality or the gills of the fish which are preventing the fish from extracting oxygen from the water. Less oxygen dissolves in the water in hot weather; in salty water; and at high altitude. Oxygen levels may also drop due to decaying waste; algae growths using up oxygen at night; or following the use of certain chemicals.

▶ Immediate: Increase oxygen levels by encouraging splashing at the water surface with cascades or fountains. Use air pumps and airstones in the pond. Temporarily reduce or cease feeding. Keep the water surface free from excess floating leaves. Examine fish gills for signs of damage or parasite infection. Carry out a partial water change taking care to remove decaying sediments.

▶ Long Term: Control excess algae growth. In heavily stocked systems, consider the permanent installation of additional aeration devices e.g. trickle towers.

? – The pH is rising unusually high (over 9.0) – alkaline conditions

▷ High pH values can directly irritate fish gills and mucous membranes as well as reducing the efficiency of nitrifying bacteria in the filter. Waste products such as ammonia are much more toxic to fish at high pH levels.

▶ Immediate: Reduce or cease feeding. Check ammonia levels. Carry out a series of partial water changes. Consider using pond pH buffers designed to lower pH.

▶ Long Term: Discover the source of the high pH. Uncured cement-work may need to be removed from the system or sealed in some way. If it is due to the replacement water source get advice from your local supplier. If it is due to strong photosynthetic activity by algae, carry out algae control measures.

? – The pH is unusually low (dropping to below 6.5) – acid conditions

▷ pH levels can fall due to the build up of nitrates or carbon dioxide (CO_2) in the water. Minerals in the water do buffer the pH preventing sudden drops but if these minerals have been exhausted, the pH may drop suddenly. Low pH water irritates fish gills and mucous membranes, reduces the efficiency of nitrifying bacteria in the filter, and makes some metals (e.g. copper) more toxic to fish.

▶ Immediate: Reduce or cease feeding. Check carbonate hardness (KH) levels (see below). Carry out partial water changes.

▶ Long term: Monitor KH levels; increase the rate of water changes.

? – The carbonate hardness (KH) is unusually low (below 3 degrees)

▷ Carbonates and bicarbonates (CO_3 + HCO_3) represent the alkalinity and buffering capacity of the water. These are used up by the filter bacteria in the process of nitrification. The problem is most notable in systems where the top-up water is naturally soft (KH 3°/50ppm or less) and where feeding rates are high.

▶ Immediate: Reduce or cease feeding. Carry out a series of partial water changes. Consider the cautious use of buffering compounds such as sodium bicarbonate ($NaHCO_3$) or powdered calcium carbonate ($CaCO_3$).

▶ Long term: Increase the frequency of partial water changes. Choose a replacement water source with naturally high carbonate levels. Add slow release buffers to the pool system e.g. tufa rock; crushed oystershell. In heavily loaded systems the regular addition of carbonate buffers may be necessary.

? – Ammonia/Ammonium levels (NH_3/NH_4) are high

▷ Outside the filter maturing period, high ammonia levels are usually caused by overloading or disruption to the filter organisms.

▶ Immediate: Reduce or cease feeding. Increase aeration. Check and remove causes of filter disruption. Carry out partial water changes.

▶ Longer term: Aim to avoid high pH values as ammonia is more toxic in these situations. Take steps to prevent future disruption/overloading of the filter. Add commercial cultures of nitrifying bacteria to the system.

? – Nitrite levels (NO_2) are high

▷ Outside the filter maturing period, high nitrite levels are usually caused by overloading or disruption to the filter organisms, or pockets of decaying material building up in anaerobic (low oxygen) areas in the system.

▶ Immediate: Reduce feeding. Increase aeration. For salt tolerant fish such as koi, add 3 grams per litre* (0.3%) of food-grade salt to the water as this reduces nitrite toxicity. (*maximum of 1g/L (0.1%) with plants)

▶ Long term: Avoid disruption of the filter organisms by e.g. medications and other chemicals; ensure that the filter is being backwashed sufficiently; add commercial cultures of filter bacteria. Monitor the KH level too.

? – Nitrate levels (NO_3) are high (over 100 mg/L total nitrate)

▷ – Nitrates build gradually in most closed systems. They are not especially harmful to freshwater fish and immediate action is not called for unless levels exceed 300 mg/L. However, chronic, high levels of nitrate are considered to lower the immunity of fish to disease, and may reduce growth rates.

▶ Long term: Carry out more frequent backwashes and/or partial water changes. Consider using plants to reduce nitrate levels. Monitor KH levels.

? – There is a high level of suspended solids in the water

▷ Suspended solids can irritate fish gills. Organic solids reduce oxygen levels & increase levels of bacteria in the water & may lead to gill disease.

▶ Immediate: Find and remove the source of the solids e.g. poor quality or inappropriately sized food; run-off from surrounds following rain; air being drawn into the BubbleBead (see page 41 point 2).

▶ Long term: Increase circulation to draw particles into the filter more quickly. Use bottom drains to remove sediments. Use quality foods. Don't overfeed fish.

? – The water has a yellow tint

▷ In any closed system there is a gradual build up of complex waste compounds e.g. phenols, which cannot be easily broken down by the filter. These can eventually discolour the water but are not normally harmful.

▶ Long term: Increase the level of backwashes and/or partial water changes. Temporarily use activated carbon in the system. Use a protein skimmer (foam fractionator), especially in salted systems. Cautious use of ozone dosing devices can help. Changing food brands can sometimes help.

? – The water has excessive amounts of foam at the surface

▷ Foaming is caused by high levels of surfactants in the water, the most common being types of protein. Some foaming may be expected during the filter maturing process but this usually disappears once the filter has fully matured.

▶ Immediate: Carry out a partial water change taking care to remove uneaten food and excess sediments. Consider the use of pond anti-foaming treatments.

▶ Long Term: As for yellowed water (above). Check that any open cell foam products used in the pool are fish-grade quality. Consider a surface skimmer.

? - How can I control blanketweed in a pond?

- Avoid debris or soil washing into the pond. Provide shade from excess sunlight. Avoid limestone rocks. Avoid long shallow streams as these tend to encourage algae. Avoid overfeeding fish. Use plants to soak up nutrients.

- Physically removal algae using a stick, net, or plastic lawn-rake - fairly effective but time consuming. Remove the bulk of blanketweed growth **before** using any chemical controls, as dying algae can rapidly pollute a pond.

- Regularly remove sediments from the pool with a bottom drain or vacuum. Clean strainers and settlement areas in filters on a regular basis.

- Some algae are to be expected in all garden ponds. Mature ponds that are not overstocked with fish tend to have the fewest problems. Do remember to backwash the BubbleBead filter at suitable frequencies.

Filter Troubleshooting

? – The water has suddenly become green / milky grey

▶ Algae blooms (green water) and bacterial blooms (milky grey water) can sometimes occur, especially during the maturing period or following a sudden increase in dissolved nutrients. The problem will be controlled by an effective UV unit. If a UV does not appear to be working, check the lamp and clean the quartz sleeve if necessary. Water with high mineral content can sometimes coat the quartz sleeves and the filter beads in scale; use of magnetic/electromagnetic devices often alleviates this problem. Other sources of cloudiness include excess food and particles washed in from surrounding soils. Temporarily cease feeding and consider the very sparing use of flocculating agents (but not in very soft water).

? – The water has suddenly become very dirty

▶ If air is being drawn into the filter system during normal running, it will disturb the beads and prevent them from catching dirt properly. Check that there are no pipework leaks around the pump or filter inlet and that the pump is not drawing in air from e.g. airstones. Check that the filter return to the pool has not been moved to a lower position, or into the water itself, as siphoning at this point can draw air into the filter through the air inlet valve (see page 23 - air breaks).

? – There has been a powercut

▶ If the powercut has only been for a few hours, there should be no problems providing the filter has been maintained correctly. RCD devices on the system should be latching types that will restart automatically. The waste valve opens automatically following a powercut, leaving the filter beads moist but well oxygenated. Filter bacteria can survive for many hours, if not days, in this state. This is a major benefit over the deoxygenating conditions of typical submerged filter beds. However, if the filter has been particularly dirty; or feeding levels particularly high; or the weather particularly warm; then the filter organisms may run out of oxygen more rapidly. In these cases or where the powercut has been lengthy (over 18 hours), carry out a backwash as soon as the filter has refilled, to remove foul water and dying organisms. Avoid feeding for a few days and monitor the water for ammonia and nitrite.

? – The filter takes much longer to drain during a backwash

? – I can hear the bead bed dropping in one lump (with a 'thunk') during the backwash cycle

? – The filter sounds different during the backwash cycle

? – The pressure gauge reading does not drop to the normal level after cleaning

▶ Slow draining can be due to gradual clogging of the inlet and/or outlet screens inside the filter, or 'gelling' of the bead bed. Screen clogging can be due to strands of algae; growths of sponge-like bryozoans within the filter; or tiny snails which have become wedged in the slots. Gelling of the bead bed is caused by beads sticking together due to an excessive growth of the biological film on the bead surfaces as a result of infrequent backwashing. **Regular backwashing of the BubbleBead filter can eliminate most of these problems before they occur.**

If these problems occur, backwash your filter four or five times in a row and increase the frequency of the regular backwash. If problems persist:

Drain the filter. Clean the shuttle valve (see page 32) and check that the hydraulic valve control-hose is not blocked or kinked. Check that the main pump strainer is not clogged. If necessary, remove and clean the inlet/outlet screens on the BubbleBead filter. If the lower screen has clogged rapidly, improve the strainer on your pump inlet and consider fitting an additional drain valve (page 37).

Take steps to improve the backwash strength e.g. increase the siphon action by increasing the waste pipe length or head (see page 13) and minimise restrictions on the waste outlet.

For persistent gelling of beads, either:

- Seal the waste outlet and turn off the pump leaving the filter full of water. Inject air into the air inlet valve with a blower or strong aquarium airpump for 30 to 60 minutes. The air accumulates under the bead bed eventually working its way upwards and breaking up the beads. Then carry out the backwash process 4 or 5 times in a row before restarting the filter.

- Partially drain the filter, remove the top outlet assembly, and break up the beads with a jet of water from a powerful hose or jet-washer. Reassemble the outlet and carry out a series of backwashes.

? – The air inlet drips water

▶ Check 'Under-pressure' symptoms below. If this, or cleaning the valve, does not help, fit a 90º bend to the exposed end of the valve and fix a 30 cm (12") long upright vertical pipe into this. This should stop the drip.

? – I don't like the plug of cloudy water that is sometimes seen in the filter output just after restarting the filter

▶ This is normal for all bead filters and does not harm the fish. Reduce the density of clouding by increasing backwash frequency, or set your timer to carry out a second backwash just as the filter has refilled. However, if you wish to eliminate clouding, fit a tee & valve, or a 3-way valve, on the filter outlet pipe and direct this plug of water to waste for a **few seconds**. Use a short piece of clear pipe/hose in the waste line to monitor clarity.

? – The backwash appears to stop before the filter has emptied

▶ This can happen if the filter is particularly low in relation to the pond water level. The shuttle valve will move over before the filter has fully drained. Ideally, raise the filter. Alternatively, see the option detailed in Appendix Three. Carry out routine TwinValve maintenance (page 32).

? – Turning off the pump gives little or no backwash from the waste outlet

▶ This can happen if:
- the hydraulic valve is sticking in the closed position. Check that the hydraulic valve feed tube is not clogged or kinked. If necessary, disconnect this tube and apply suction to remove water from the hydraulic valve controller. Carry out routine maintenance on the valves (see p.32).
- the inlet strainer in the filter is becoming clogged.
See the section on page 34.
- see below.

? – Turning off the pump gives no backwash from the waste outlet and filter water appears to run back into the pond

▶ This can happen if the shuttle valve is sticking in the 'run' position. This rare problem is more likely if backwashes are very infrequent. Allow the filter to drain down and carry out a full clean and examination of the valves as detailed on page 32.

? – The waste outlet continues to dribble water

▶ On new systems, carry out the valve membrane stretching described on page 25. Persistent dribbling can be a symptom of '**Underpressure**' (see the section on page 23). Test to see if this is the case by temporarily holding your hand partially over the return pipework to increase the pressure in the filter. If the valve then closes within a few minutes, underpressure is the problem. Solutions to underpressure include:
- raising the end of the pipe where water returns to the pond so that it is higher than the filter inlet
- opening the small venturi inlet valve fitted to the top outlet (see below)
- alternatively, placing a **small** restriction in the return pipework to the pond to increase pressure in the filter. (Larger restrictions and valves create excess backpressure which should be avoided (see page 52)).

Carry out routine valve maintenance (p32/33) taking care to clean the hydraulic valve seat, and check that the hydraulic feed pipe is not clogged or kinked. Removing the lower arm (page 33) allows close examination of the hydraulic valve. If blowing into the hydraulic feed pipe does not completely close the valve, the facing plate can be adjusted on its nylon thread - refix it with a tiny blob of paint. If you can blow right through the membrane, contact your dealer.

? - The top venturi valve leaks intermittently when open

▶ The venturi valve has been fitted to models since mid 2002. It helps to aerate the return water to the pond, and it can reduce or eliminate the issue of underpressure in the filter by breaking siphon action in the return water flow. When open, this valve can leak a small amount of water at the start or end of the backwash cycle in some outlet pipe configurations. Ask your dealer about the one-way valve accessory for this or alternatively pipe the water to waste. Where restrictions are placed in the return pipework e.g. UV units or control valves (N.B. see page 52 on valve use) then the venturi valve will not function properly and must be kept closed.

? - A vibrating noise is coming from the shuttle valve

▶ In certain circumstances the pressure from the pump and the tension in the shuttle valve spring sets up resonances which cause the valve plate to vibrate in the water flow. Clean the shuttle valve (page 32) and gently stretch the spring to alter the spring tension, before reassembly. Replacement valves are available if the spring becomes damaged/worn.

? – I'm going away on summer holiday for two weeks

▶ In lightly stocked water garden ponds the fish will find some natural food. This can be supplemented by small amounts of food from an automatic fish feeder. Double check that all the valves in the system are working correctly. It is worth carrying out routine maintenance (page 27-29) some days before you go on holiday, to check that everything is in order. The automatic backwash can then take care of your pond providing you also have an automated top-up system.

Alternatively, as the reduced feeding will reduce the loading on the filter, it should be possible to leave the filter for the two weeks without a backwash. (Remember that very high pressure pumps must always be fitted with a pressure-release bypass, see page 52). Carry out a triple backwash before leaving and carry out a triple backwash on your return. Alternatively, where someone is coming in to feed the fish, they can be shown how to operate the simple backwash process.

? – How can I use my pump to drain the pond through the filter ?

Remove the shuttle valve (see page 28) and disable the hydraulic valve by disconnecting the valve feed-pipe and sealing the opening on the main filter inlet pipe. The hydraulic valve membrane will then automatically go into the open position and remain in that position. Turning on the pump will then flush pond water directly to the waste outlet.

Further answers are on the website 'F.A.Q.' pages:
www.bubblebeadfilters.co.uk

If you experience other problems, not mentioned here, please seek further advice from your dealer (or the distributor - contact details on the inside back page).
Unauthorised repairs or modifications may void the guarantee!

APPENDIX ONE

Installing UV units

Germicidal UV radiation has been shown to be most effective in controlling green water algae in ponds and commercial UV units are now widely available. (The integral BB-55 UV unit for BubbleBeads is currently unavailable).

Be sure to choose a unit:

- of sufficient wattage (see the table on page 11)

- designed to cope with the expected flow rates without causing excess restriction. The fittings on the unit should be at least as large as the return pipework used, e.g. if 1½" hose is being used on the return pipework, the unit should be used with 1½" hosetails. (A unit with 1" connections adapted up to 1½" hose would not be suitable unless a bypass was fitted.)

INSTALLATION

UVs are best plumbed into the clean water flow returning to the pond from the filter. Be sure to support the UV and pipework sufficiently with brackets and pipe clips etc. Unsupported pipework on the filter outlet could damage the filter and void your guarantee. Ensure that the unit is accessible for maintenance, dismountable for repair/replacement, and that electrics are suitably protected from water.

OPERATION

Never look directly at any UV lamp when lit. The UV radiation is damaging to both eyes and skin! Only operate the UV when the lamp is safely inside the unit and the filter is running. It will be OK running 'dry' for the short few minutes of a normal backwash. If it is connected to the same supply as the pump it will automatically switch off during the backwash, though repeated switching of the lamp can shorten its effective life. Follow the manufacturer's guidance on maintenance and lamp changing.

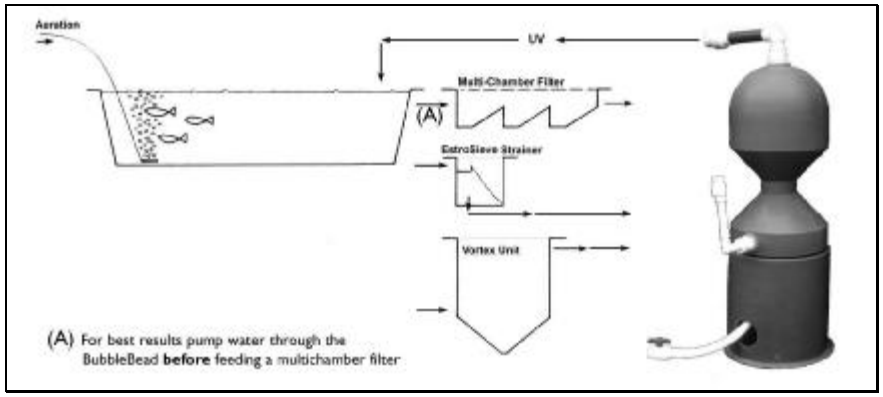
On new systems it is best to leave the UV turned off during the first two to four weeks of filter operation to minimise damage to beneficial bacteria present in the water flow whilst the filter beads are becoming colonised.

APPENDIX TWO

Combining BubbleBead Filters with other filter equipment

The BubbleBead filter is ideal to use alongside existing filter equipment and can boost the filtration capacity of any system. This is particularly useful if an increase in fish stocks is overloading the existing system. In particularly high loading situations the BubbleBead filter can be supplemented with ancillary equipment to give the best results.

Aeration is recommended in all cases. Where natural aeration from waterfalls or fountains is limited, the most convenient form of supplementary aeration is to use a high efficiency air pump with airstones in the pond. Ensure air bubbles do not get drawn into the BubbleBead filter.



The **'EstroSieve' Strainer** is a novel patented design that can be used in gravity or pump fed systems. When using with BubbleBead filters, the compact EstroSieve unit would normally be sunk to pond level beside (or within) the pond and fed by gravity. Water from the pond passes through a sieve constructed from finely engineered triangular blades. The blade spacing (from 0.1 to 0.6 mm

depending on the model) ensures that all coarse particles are lifted from the water. The sieve element has a high surface area and collected waste can be flushed to waste. The sieve can also be removed for cleaning. The strained and aerated water is then pumped to the BubbleBead filter. Use of the EstroSieve effectively prevents large solids from clogging the inlet strainer of the BubbleBead Filter and assists the main filter in removal of organic particles before they break down, so helping to **reduce algae growth**. Ask your dealer for further information on this unit.

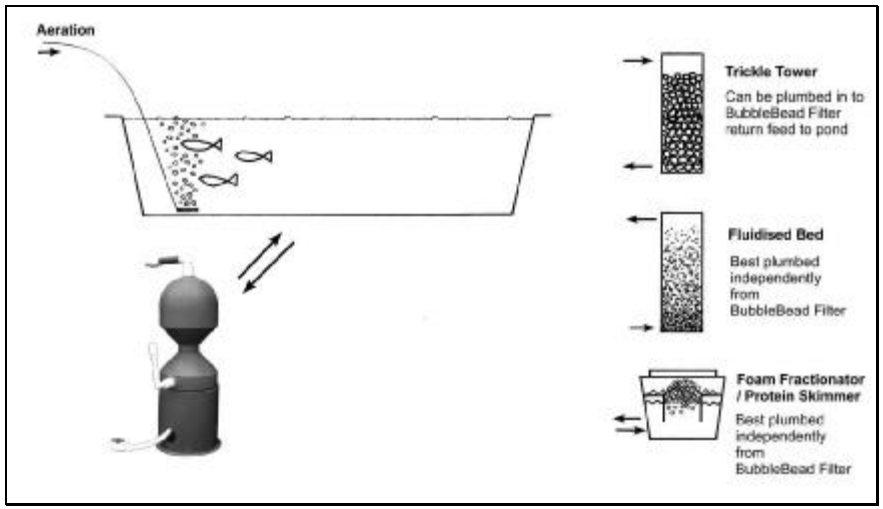
With existing **gravity-fed multichamber systems** the most straightforward option is to pump the water from the last chamber of the filter to the BubbleBead filter and then back to the pond through a UV unit. The BubbleBead filter will give additional nitrification of fish wastes and will also help to 'polish' the water by removing the small particles that can sometimes get through multichamber systems. **However**, this arrangement does **not** make use of the BubbleBead filter's ability to remove the bulk of solids from the system before they break down, and unless excess solids are regularly removed from the multichamber filter there may be an increased tendency for blanketweed growth in the system. It is preferable to adapt the multichamber filter to pump fed operation.....

For existing **pump-fed multichamber systems**, the water should be pumped instead to the BubbleBead filter, through a UV unit and into the chamber filter before returning to the pond by gravity. When regular backwashes are carried out this will make the best use of the BubbleBead's ability to remove solids from the system before they are broken down. The multichamber filter will then remain cleaner and more able to function as a biological filter rather than a mechanical trap for sediments. It is important to use a suitable strainer on the pump feeding the BubbleBead filter to remove larger solids; and to ensure sufficient aeration in the chamber filter's transfer ports. This arrangement is not suited to pressurised chamber filters.

With **Vortex Units** and existing gravity-fed settlement or brush chambers, water can be pumped from these to the BubbleBead Filter as shown. However, it is important to clean these chambers very regularly to remove organic waste before it is broken down, otherwise blanketweed growth may be a more noticeable problem. The solids removal abilities of vortex units can be significantly improved by retrofitting commercial

devices such as 'The Answer' and 'The Solution' which are both types of **self cleaning strainer**.

Trickle Towers can be fed from the outflow of the BubbleBead filter, following UV treatment. The trickle tower greatly boosts oxygenation of the water and assists nitrification in heavily loaded commercial situations. Water then flows back to the pond from the trickle tower under gravity.



Fluidized Bed Filters boost nitrification capacity in heavily loaded systems but are unable to remove solids. They can be used alongside the BubbleBead Filter which will remove the solids from the system.

Foam Fractionators (Protein Skimmers) aid the removal of proteins and other surface active compounds from the water, reducing the load on other filter equipment and improving water clarity by removing staining compounds. Although foam fractionators show some benefits in freshwater, they work most efficiently on marine systems. They are not intended to remove solids from the water.

Certain foam fractionators can also be used with specialist ozone systems to control yellowing of the water and to reduce slime and algae growth.

Both fluidized beds and fractionators should be plumbed **independently** from the BubbleBead Filter.

APPENDIX THREE

Using the BubbleBead filter in sites below the level of the pool surface.

If the filter is mounted at a level where the main filter inlet ends up being lower than the water level in the pool (from which water is being pumped), the filter may not function correctly. In these cases, during backwash, the water in the filter will only drop down to a level equivalent to that of the pool level. This can result in an incomplete cleaning of the beads, or in sites where the filter is particularly low, no cleaning at all. The hydraulic valve may also not open properly due to the remaining pressure in the hydraulic feed pipe from water in the inlet pipework.

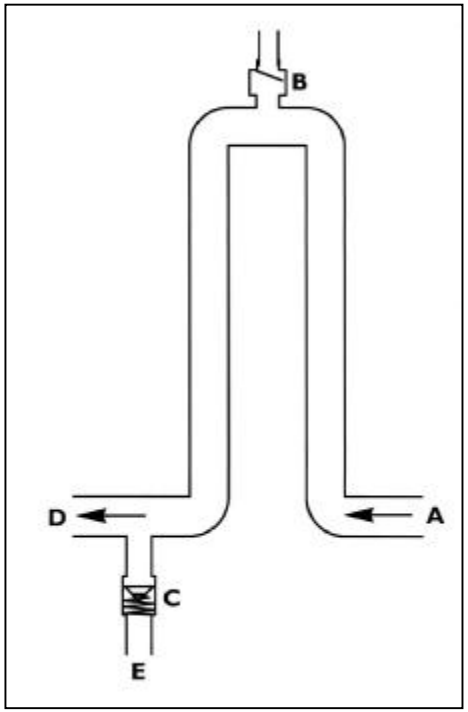
There are a number of ways of overcoming this situation.

1) **Raise the filter**. Raise the BubbleBead filter e.g. on a block stand (page 13) so that the base of the main filter inlet pipe is at least as high as the level of water in the pond.

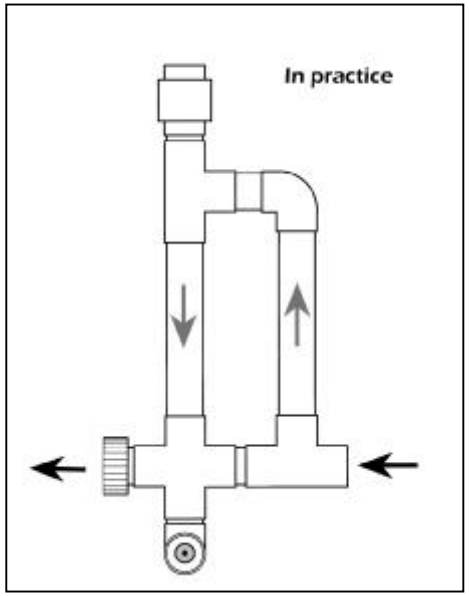
2) **Fit a low-site valve assembly**
If it is not convenient to site the filter in a higher position, it is possible to fit an extra piece of plumbing that will still allow the filter to function fully effectively.

Water is pumped from the pond (A) into the raised section of pipe which should reach 30cm above the pool surface level. Water passes out at (D) and into the standard BubbleBead filter inlet. In normal running the pump pressure keeps the check-valve (B), and the spring loaded release valve (C) shut.

A modified shuttle valve is used instead of the original shuttle valve supplied with the unit.



Low-site valve assembly - In principle



When the pump is turned off for backflush, the pressure in the pipe drops. The check-valve (B) opens and allows air into the pipe to break any siphon action. The spring loaded valve (C) opens and releases a small volume of water from the pipework to waste (at E). The replacement shuttle valve in the BubbleBead filter moves into the drain position and the hydraulic valve can fully open, allowing complete drainage of the filter and a full backwash. When the pump is restarted the valves at B and C close, and water is pumped once more into the filter.

To prevent restriction of flow from the pump, ideally use large pipework and swept bends. Details of this accessory should be available from your dealer or the distributor. An installation leaflet is available for download from the BubbleBeadFilters website.

3) **Adapt the filter to manual operation.** This is a less desirable option as it loses the benefits of the automatic backwash, however it can be cheaper than fitting the low site valve assembly. Remove the shuttle valve. Disconnect the hydraulic feed pipe from the dismountable union and seal the hole. Fit a 2" valve to waste outlet and to the inlet fit either:

- a one way valve with a pressure loaded spring (strong enough to prevent water running in from the pond, but weak enough to allow the pump to push water past it).

- or another 2" valve.

In normal running the inlet valve is open and the waste outlet is closed. To backwash, the pump is turned off, the inlet valve manually closed (the spring valve alternative closes automatically), and the outlet valve opened.

APPENDIX FOUR

- Using the filter with a high pressure pump

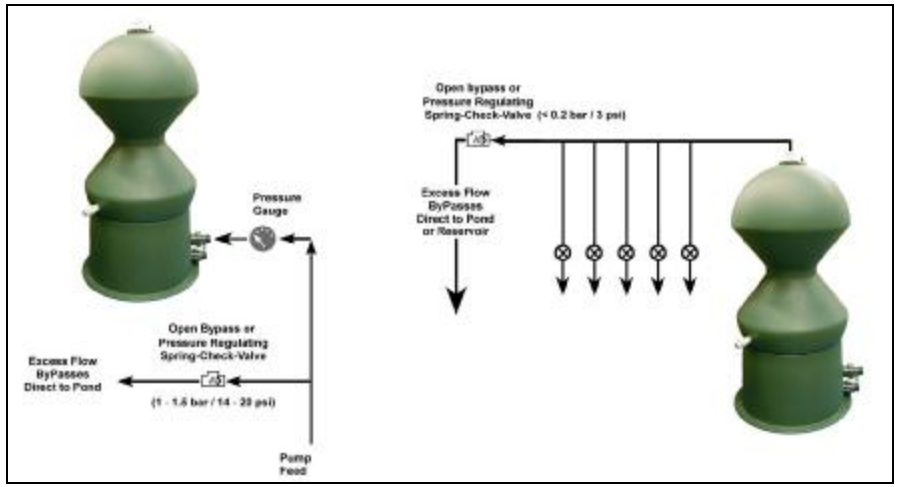
- Fitting manifolds to the outlet pipework for returns to multiple tanks (e.g. shop and aquaculture systems)

- Using flow control valves on the return pipework

When using high pressure pumps on the inlet, a bypass is essential to prevent damage to the filter body and the membrane in the hydraulic valve. The filter is rated to 1.5 bar (15 metres head), but as some pumps can create pressure surges well in excess of this on start up (especially where there is air in the pipework) we consider it **essential** that a bypass/pressure release is used on systems with pumps rated with heads of over 10 metres. A pressure gauge is also strongly recommended.

Using narrow pipe manifolds, small bore UV units, and/or valves on the filter outlet can create unwanted backpressure in the filter system, increasing the likelihood of weeping from the threads and hydraulic valve. In cases with high pressure pumps, the pressure in the filter system can also exceed rated limits. Fit a bypass or pressure release on the outlet manifold.

The diagram shows where a bypass or pressure release valve could be fitted in a system with a high pressure pump (left), or with a manifold on the outlet (right).



Filter Specifications

Details of the filter dimensions and specifications are given in the table on page 11, and approximate backwash volumes on page 30. BubbleBead Filters undertake continuous product development may make technical modifications in current models. The information and pictures shown here are for guidance only.

Pipe fitting sizes on inlet/outlets

These will vary according to what your dealer has specified.

Typically the fittings are as follows:

Model	**BBF-3***	**BBF-5***	**BBF-7**	**BBF-9**
Inlet:	2" male BSP	2" male BSP	2" male BSP	2" male BSP
Waste:	2" male BSP	2" male BSP	2" male BSP	2" male BSP
Outlet:	1½" fem solv.	1½" fem solv.	2" fem solv.	2"/3" fem solv.

BSP = British Standard Pipethread solv. = Solvent Weld (pressure)
Inlet and waste fittings incorporate a dismountable union.
(*BBF-3 & 5 TwinValve models)

References and Sources quoted:

AST technical literature, and:

[1] Malone, R.F., Beecher, L.E., 2000. Use of floating bead filters to recondition recirculating waters in warmwater aquaculture production systems. Aquacultural Engineering 22: 57-73.

[2] Malone, R.F., Rusch, K.A., 1998. Using the bead filter in your koi pond (Second Edition). Louisiana Sea Grant College Program. 50pp.

Drennan, D.G., Golz, W., Ahmed, H., Malone, R.F., 1995. Clarification abilities of floating bead filters used in recirculating aquaculture systems. In: Aquaculture Engineering and Waste Management, Proceedings from the Aquaculture Exposition VIII and Aquaculture Mid-Atlantic Conference, Washington, D.C., June 24-28, pp. 256-267.

If the filter should arrive damaged or with parts missing please contact your supplier immediately, and confirm losses in writing within seven days to allow the problem to be corrected.

FILTER GUARANTEE

The filter manufacturer guarantees that the filter material and workmanship are free of defects. The guarantee is valid for paid goods and runs for one (1) year from the date of delivery.

Any filter returned to the dealer or distributor carriage paid, which is proved to the manufacturer's satisfaction to be faulty by reason of defective material or workmanship will be replaced or repaired, at their option, free of charge, provided it has not, in the manufacturer's opinion, been subjected to misuse, neglect or accident. In particular:

1) The filter should have been installed and maintained in accordance with the instructions.

2) Excessive weight due to heavy pipes, valves, etc. should not be carried by the inlets or outlets.

3) The filter hull pressure is at no time to be allowed to exceed the maximum pressure rating as specified by the manufacturer.

The guarantee does not apply to filters used for other than the intended purpose; those altered, repaired or modified by other than an authorised repairer; or those used with other items where the integrity, performance or safety of these items is affected. Damage by natural forces such as storm, ice, or animal, is excluded from the guarantee.

The distributor and the filter manufacturer will not be liable for any direct or consequential loss. Any claim made under this guarantee must be accompanied by proof of purchase. This guarantee does not affect your statutory rights as a consumer.

If problems should arise, in the first instance contact your local dealer or your nearest distribitor (see page 55)**.**

If your filter was supplied with a serial number, please note it here for reference:

Serial No.:_____

Typical measurements for your BubbleBead filter

(see page 26)

Time taken to *drain* the filter when relatively clean: _____

Time taken to *refill* the filter when relatively clean: _____

Troubleshooting

If you have problems with **water quality** please first read the guidelines starting on page 38.

If you are encountering difficulties in **maintaining your filter**, please firstly read the sections starting on page 32 & 41.

The BubbleBead Web-Site carries useful support information:
www.bubblebeadfilters.co.uk

If you require further assistance please contact your dealer or contact your local area Distributor. It is a help to have all the relevant information about the filter, model number; pump type; valves and hoses etc. to hand.

Distributors:

Aquatica International, England
Tel: 020 8669 6643 *(Fax: 020 8773 2035)*
Email: info@bubblebeadfilters.co.uk

Estrad bv, Holland
(Fax: 529-484-999)
Email: info@estrad.nl

WATER GARDEN GEMS, Texas
Tel: 210-659-5841 *(Fax: 210-659-1528)*
Email: USinfo@bubblebeadfilters.com

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Dealer Details: